APPENDIX A

GROUNDWATER MODEL DESCRIPTION

MODFLOW96

NAME

MODFLOW96 - Modular three-dimensional finite-difference ground-water flow model

ABSTRACT

MODFLOW is a three-dimensional finite-difference groundwater flow model. It has a modular structure that allows it to be easily modified to adapt the code for a particular application. Many new capabilities have been added to the original model. OFR 96-485 (complete reference below) documents a general update to MODFLOW, which is called MODFLOW-96 in order to distinguish it from earlier versions.

MODFLOW simulates steady and nonsteady flow in an irregularly shaped flow system in which aquifer layers can be confined, unconfined, or a combination of confined and unconfined. Flow from external stresses, such as flow to wells, areal recharge, evapotranspiration, flow to drains, and flow through river beds, can be simulated. Hydraulic conductivities or transmissivities for any layer may differ spatially and be anisotropic (restricted to having the principal direction aligned with the grid axes and the anisotropy ratio between horizontal coordinate directions fixed in any one layer), and the storage coefficient may be heterogeneous. The model requires input of the ratio of vertical hydraulic conductivity to distance between vertically adjacent block centers. Specified head and specified flux boundaries can be simulated as can a head dependent flux across the model's outer boundary that allows water to be supplied to a boundary block in the modeled area at a rate proportional to the current head difference between a "source" of water outside the modeled area and the boundary block. MODFLOW is currently the most used numerical model in the U.S. Geological Survey for groundwater flow problems. An efficient contouring program is available (Harbaugh 1990) to visualize heads and drawdowns output by the model.

METHOD

The groundwater flow equation is solved using the finite-difference approximation. The flow region is considered to be subdivided into blocks in which the medium properties are assumed to be uniform. The plan view rectangular discretization results from a grid of mutually perpendicular lines that may be variably spaced. The vertical direction zones of varying thickness are transformed into a set of parallel "layers." Several solvers are provided for solving the associated matrix problem; the user can choose the best solver for the particular problem. Mass balances are computed for each time step and as a cumulative volume from each source and type of discharge.

Reference: Above description extracted from USGS Water Resources Application Software.

APPENDICES B AND C

SAMPLE MODEL INPUT AND OUTPUT FILES
(See CD in Pocket)